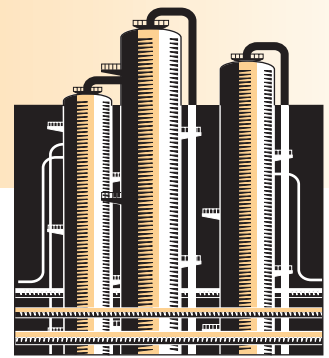


# PETROLEUM

## Project Fact Sheet



## DISTILLATION COLUMN FLOODING PREDICTOR

### INNOVATIVE TECHNOLOGY PREDICTS AND AVOIDS LIQUID AND JET FLOODING IN THE PETROLEUM REFINING PROCESS

#### Benefits

- Increases column throughput 2 to 5 percent with greater margin of safety
- Increases efficiency of the refinery process, thus increasing gasoline production by allowing the column to be run closer to the true flood limit
- Reduces flooding in distillation, absorption, and stripper columns
- Reduces equipment damage resulting from column flooding conditions
- Lowers implementation and significantly lowers maintenance costs

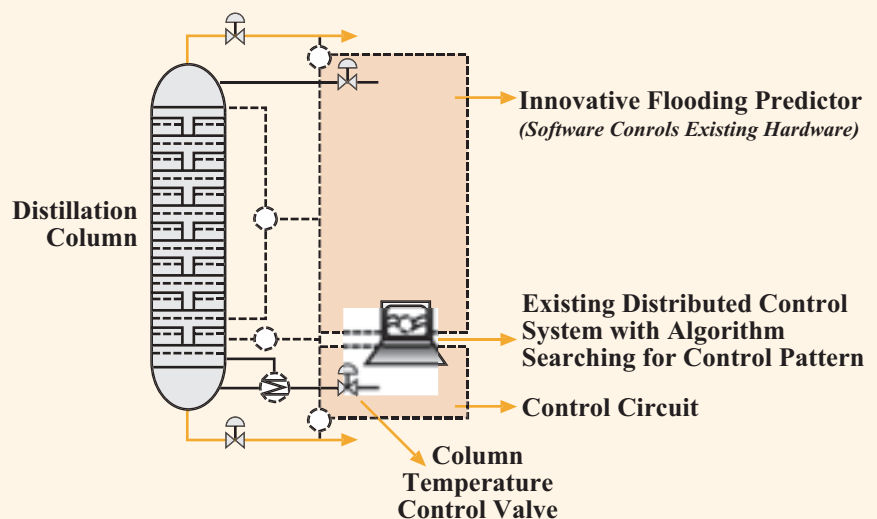
#### Applications

Within the refining industry, proprietary versions of the technology have been applied to fluid catalytic cracker (FCC) units, Sats Gas Absorber Columns, FCC main Fractionators, Stripper Columns, and H<sub>2</sub>S Scrubber Columns. This concept is potentially applicable in other areas of pattern-intensive diagnostics, such as cardiac telemetry units and blood glucose monitoring devices, anywhere the assessment of raw data is primarily dependent on interpretation of data-sets or patterns.

Petroleum refiners use advanced process tools to prevent flooding of distillation columns at refineries. Typically, these controls are used in conjunction with multivariable predictive-control technologies that are either licensed through a vendor or developed in-house. These conventional control strategies are commonly used to predict the column's approach to flood by monitoring the column delta pressure; however, they allow damage and lost productivity because they are based on raw data.

A new control technology provides a more accurate estimation of distillation-column flooding. The distillation column flooding predictor is a pattern-recognition system that identifies patterns of transient tower instabilities, which have been discovered to precede tray flooding. This non-intrusive technology processes signal data obtained from existing column instrumentation. Once the pattern is identified, it is modeled and coded into the plant's distributed control system. The control system is programmed to briefly unload the tower each time the pattern appears by momentarily reducing temperature input to the tower.

#### DISTILLATION COLUMN FLOODING PREDICTOR



A new distillation column flooding predictor for the petroleum refining industry unloads the tower briefly at pre-flood stage, resulting in more stable long-term column operation and increased throughput.



## Project Description

**Goal:** Field test, revalidate, and obtain public data on the performance and capabilities of the distillation column flooding predictor to facilitate market penetration.

The distillation column flooding predictor is a patented, pattern-recognition technology that predicts liquid and jet flooding in the petroleum-refining process. The system identifies patterns of transient tower instabilities, which have been discovered to precede tray flooding. This closed-loop system duplicates the thinking of an expert operator or engineer in tower operation and can detect a pre-flood condition that occurs 5 to 60 minutes before the actual flood event.

Current predictive-control techniques often rely on tower delta-pressure to indicate an approach to flood. However, many distillation processes experience day to day fluctuations in these feed variables, which limits the accuracy of this predictive-control method to predict a flooding event.

In contrast, the distillation column flooding predictor accurately predicts a flood event, temporarily relaxes the severity, and avoids actual flood conditions. This allows for more stable long-term operation, resulting in greater efficiency and throughput increases of up to 2 to 5 percent. In addition, fewer flooding events will reduce equipment damage that results from such events.

2ndpoint, L.L.C., is developing and acquiring public data for this new technology with the help of a grant funded by the Inventions and Innovation Program in the Department of Energy's Office of Industrial Technologies.

## Progress and Milestones

- Tests conducted at the Separations Research Program, Center for Energy and Environmental Resources, The University of Texas at Austin, concluded: "The pattern recognition software works well with both packing and trays." "...capacity can remain higher for longer periods of time." and "...it can be installed on nearly any process control computer, in addition to and working with any other software packages already on the computer."
- Develop training and technical manuals and appropriate software.
- Develop marketing plan and accompanying tools.
- Identify and pursue opportunities for licensing or joint-venture strategies.
- The invention is patented under U.S. patent 5,784,538.
- Having independently validated the technology at the Separations Research Program, The University of Texas at Austin, the inventor is currently seeking an industrial partner for commercialization and licensing of the technology.

## Economics and Commercial Potential

Although financial, environmental, and legal considerations make it unlikely that new refineries will be built in the United States, expansion at existing refineries will likely increase total U.S. refining capacity in the long run.

Looking at industry statistics, industry representatives are inclined to agree that the distillation column flooding predictor, which increases efficiency and column throughput, is worth exploring.



The Inventions and Innovation Program works with inventors of energy-related technologies to establish technical performance and to conduct early development. Ideas that have significant energy-savings impact and market potential are chosen for financial assistance through a competitive solicitation process. Technical guidance and commercialization support are also extended to successful applicants.

For project information, contact:

**George E. Dzyacky**  
2ndpoint, L.L.C.  
9238 Olcott Avenue  
St. John, IN 46373-9289  
Phone: (219) 712-0434  
or (219) 365-8336  
Fax: (800) 417-8940  
ged@2ndpoint.com

Home Page:  
[www.2ndpoint.com](http://www.2ndpoint.com)

For more information about the Inventions and Innovation Program, contact:

**Lisa Barnett**  
Program Manager  
Inventions and Innovation Program  
Phone: (202) 586-2212  
Fax: (202) 586-7114  
lisa.barnett@ee.doe.gov

Visit our home page at  
[www.oit.doe.gov](http://www.oit.doe.gov)

Office of Industrial Technologies  
Energy Efficiency and  
Renewable Energy  
U.S. Department of Energy  
1000 Independence Avenue SW  
Washington, D.C. 20585-0121



Order # I-PE-775  
February 2002